CARSON LAKE PASTURE
MERCURY SUPERFUND SITE
SOIL INVESTIGATION

Department of Interior
Bureau of Reclamation
Mid-Pacific Region
Sacramento, California

July, 1993

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REMEDIAL INVESTIGATION STUDY

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January 1993

PROJECT/TASK ORGANIZATION

The investigation of the Carson Lake Pasture Mercury EPA Superfund Site (CLkP) will be conducted by MP-705 staff of the Bureau of Reclamation's (Reclamation) Mid-Pacific Regional Office in Sacramento, California. The investigation is being performed at the request of Reclamation's Lahontan Basin Project Office in Carson City , Nevada through Reclamation's Mid-Pacific Hazardous Waste Coordinator (MP-405). MP-705 personnel involved include Chief of the Quality Assurance Branch (project head) and physical scientists specialized in field sampling and quality assurance/quality control (QA/QC). Analytical laboratory services are being provided by CH2M Hill's laboratory in Redding, California.

Data collected during this investigation will be used by Reclamation and the State of Nevada as part of the negotiations of the transfer of this area to the State of Nevada. The transfer of this land is required per Section 206(e) of Public Law 101-618.

PROBLEM DEFINITION/BACKGROUND

This Level III remedial investigation sampling plan focuses on approximately 30,000 acres of Reclamation's withdrawn land known as the Carson Lake Pasture. Reclamation's Mid-Pacific Regional Solicitor's Office has determined that Reclamation is the appropriate agency to perform the Level III survey required by the Department of Interior's policy and to issue the notice required under Section 120(h) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

The Carson River drains 3,980 square miles in east-central California and west-central Nevada. The Carson River begins in the eastern Sierra Nevada Mountain Range, south of Lake Tahoe and generally flows north eastward and eastward to the Carson Sink. The flow of the Carson River is interrupted west of Fallon, Nevada by Lahontan Reservoir, part of the Newland's Irrigation Project. Below Lahontan Dam, flow is routed through a complex network of ditches, drains, and canals. Irrigation return flow eventually discharges to Carson Lake, Stillwater National Wildlife Refuge, or the Carson Sink.

Mining in the Carson River drainage basin commenced in 1850 when placer gold deposits were discovered in the Comstock Lode. Mercury introduced into the region in the late 1800's to process gold and silver ore from the Comstock Lode is thought to be the primary source of the mercury contamination within the drainage basin. In previously sampled soils (Ecology and Environment, Inc. September 17, 1991 report) in the CLkP, mercury concentrations ranged from 1.70 ppm to 18.00 ppm. The U.S. Environmental Protection Agency (EPA) considers the CLkP to be part of the Carson River Mercury Superfund Site.

PROJECT/TASK OBJECTIVES AND DESCRIPTION

The objective of this investigation is to determine whether the soil in the CLkP exceeds the EPA's hazardous waste level criterion for mercury and whether there is the possibility of mercury bioaccumulation to organisms.

Based on the previous soil mercury data collected by Ecology and Environment, Inc. in the CLkP area, MP-705 personnel statistically calculated that 23 sample sites would provide a 99% confidence level of identifying any area exceeding EPA's hazardous waste criterion of 20 ppm for soil. Allowing for any possible errors, an error factor of 10% was included in the total number of sites. This 10% error factor resulted in adding 2 more sites for a total of 25 sample sites. These 25 sampling sites are located (figure 1) within the CLkP study area that has been flooded in many previous years. The location of the 25 sites to be sampled were generated using Reclamation's Geographical Information System (GIS). An array generator used an iterative process to optimally fill and systematically and uniformly distribute the sampling sites within the non-uniform study area. Another 5 sites were systematically chosen in the surrounding non-flooded area to provide background mercury data.

The field work is scheduled to commence on December 10, 1992 and be completed by December 17, 1992. Laboratory turnaround time is scheduled for 30 days from the receipt of the last sample to receipt of a full data package. Approved sample results will be available by January 8, 1993. Data evaluation

and map generation is estimated to take another 14 days after sample results are received from the CH2M Hill laboratory.

DATA QUALITY OBJECTIVES FOR MEASUREMENT

As the CLkP is part of the Carson River Mercury Superfund Site, and this investigation is determining whether or not total mercury levels exceed EPA hazardous waste criteria of 20.0 mg/kg at this site, or toxicity characteristic leaching potential (TCLP) mercury levels exceed criteria of 0.2 mg/l, data collection activities require a high degree of qualitative and quantitative accuracy. To achieve this high degree of quality assurance, the samples will be analyzed and results validated based on protocols defined in EPA's Contract Laboratory Program (CLP). Adherence to CLP protocol is required for Superfund related programs to ensure that all environmentally related measurements supported by EPA are verifiable and defensible. Decisions and actions based on the data produced by this investigation must be made with a high degree of confidence in the quality of the data. Therefore, all analyses for mercury, the element of concern in the area, will follow CLP protocol. Reclamation wishes to establish the levels of other elements in the area as well, but the high degree of supportability is not needed for this data at the present time. Samples collected for metal analyses other than mercury will be analyzed following Reclamation QA/QC guidelines.

DOCUMENTATION AND RECORDS

The final data report for the CLkP will include analytical results and a quality assurance summary review. Documentation backing this data will include raw data, instrument printouts, and results of instrument calibrations and laboratory QC checks as required by CLP protocol. External QA sample results and summary review, as well as a field sampling narrative documenting any notable problems or occurrences during sample collection, will also be on file with Reclamation's Mid-Pacific Region Quality Assurance Branch.

SAMPLING PROCESS DESIGN

The soil sampling plan will entail sampling at 0-6", 21-27" (average depth 2 feet), and 57-63" (average depth 5 feet) depths. These sampling depths assume a water table is not present within 5 feet of the surface. If a water table is encountered, samples will be taken at 0-6", 21-27", and at 6" above the water table.

Composite soil samples will be taken using a stainless steel soil bucket hand auger. The auger will be cleaned and rinsed 3 times with deionized water between each sample and each site. All sampling methods will be in accordance with EPA approved methods. The soil samples will be collected in 32 oz plastic wide mouth containers. Each container will be labeled with a site specific identification number, date of collection, time of collection, analysis requested, and any preservation method. A certificate of analysis for container contamination will be filed at Reclamation's Mid-Pacific

Regional Office located at 2800 Cottage Way, Sacramento, California. The sample containers will be placed in a cooler (that is cooled to 4 degrees C) with two chain of custody seals placed on the cooler to ensure sample security.

SAMPLE HANDLING AND CUSTODY REQUIREMENTS

A logbook will be used to record the following: conditions under which the samples are collected; person(s) collecting the samples; time and date of collection; sample identification number; and sample collection technique. Field sheets will be used to record the identification of the sample, any field measurements taken, collection date, and names of person(s) collecting the sample.

A chain of custody sheet will be used to record the sample identification, number of containers, analyses to be performed and dates and times documenting transfer of sample custody. The log book and the field sample sheets will be kept at Reclamation's MP-705 office located at 2800 Cottage Way, Sacramento, California. The chain of custody will accompany the samples from the site to the laboratory with a copy being filed in Sacramento.

ANALYTICAL METHODS REQUIREMENTS

The Contract Laboratory will be required to adhere to the analytical method "Mercury Analysis in Soil/ Sediment by Manual Cold Vapor Technique", EPA Method 245.5 CLP-M , from the USEPA Contract Laboratory Program Statement of Work For Inorganic Analysis, Document number ILM01.0, for analysis of total mercury. Those samples with greater than 3.50 mg/kg total mercury will be analyzed for mercury following EPA's Toxicity Characteristic Leaching Procedure (TCLP), Method 1311 of EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition" (Manual SW-846).

Reclamation's Soil and Water Laboratory, Missouri-Souris Projects Office, in Bismarck, North Dakota, will prepare soil samples for future ICP analysis following EPA's Method 3050A, Acid Digestion of Sediments, Sludges, and Soils. The resulting samples will be sent to Reclamation's Mid-Pacific Water Quality Laboratory (WQL) in Sacramento, California, for ICP analysis of a variety of metals. ICP analytical methods are on file at the WQL in Sacramento.

QUALITY CONTROL REQUIREMENTS

As checks on precision, accuracy, and contamination, Reclamation's Mid-Pacific Region QA personnel will incorporate external quality assurance samples into the sample batches prior to submittal to the contract laboratory. These reference samples will include blank soils, certified soil reference materials, and field duplicates. These quality assurance samples will receive sample identification similar to all other samples in order to submit them to the laboratory as blind samples. The quality control criteria for these samples will be the same as that required for the laboratory quality control

samples.

EPA's CLP dictates the frequency and type of quality control samples the laboratory must include during analysis when following CLP protocol, and specifies the criteria that quality control samples must meet. There is a copy of the USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, document number ILM01.0, available at Reclamation's MP-705 office in Sacramento. The criteria set forth in EPA's National Functional Guidelines for Evaluating Inorganic Analyses will be used to validate the laboratory quality control results as well as results of the external quality control samples.

Certified reference and blank soils will be incorporated into batches sent to Reclamation's Bismarck laboratory for digestion to test for contamination and digestion recoveries. These will be submitted in duplicate to also test the precision and accuracy of the ICP analyses from Reclamation's Mid-Pacific Region WQL. Quality control results of the ICP analyses will be validated according to the criteria specified in Reclamation's Quality Assurance Guidelines.

INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Laboratory protocol for instrument maintenance procedures is specified in CH2M Hill's laboratory manual, on file with MP-705 in Sacramento. An on-site system audit was performed by Reclamation's MP-705 QA personnel in December 1991, and instrumentation was found to be up-to-date with well documented logbooks and service contracts with manufacturers in place.

INSTRUMENT CALIBRATION AND FREQUENCY

CH2M Hill specifies instrument calibration procedures in their laboratory manual. Calibration procedures and frequency for CLP analyses are also specified in the EPA CLP Statement of Work.

DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

All data from the total mercury and TCLP mercury analyses will include a complete data package with all holding time, quality control, blank, spike and duplicate, calibration, and run information. These results as well as the external quality assurance samples will be validated following the EPA's Functional Guidelines for Evaluating Inorganic Analyses. The results must meet the criteria specified in these guidelines and the CLP Statement of Work. Data not meeting these criteria will be qualified accordingly, and a narrative summary of the review will be provided with the sample results.

The results of the samples analyzed by ICP will be validated against Reclamation's Quality Assurance Guidelines, as attached. All laboratory quality control results as well as external quality assurance sample results will be evaluated and qualified, and a narrative summary of the review will

accompany sample results.

Bureau of Reclamation, Mid-Pacific Region

Acceptance Criteria for Inorganics in Soils

Duplicates:	For values > 5X Detection Limit, Relative Percent Difference (RPD) $\leq$ 35%
	For values $\leq$ 5X Detection Limit, difference must be within $\pm$ 2X detection limit
Spikes:	Recovery should be 65% - 135%
	Limit does not apply when sample value exceeds spike concentration by 5X or more
Reference soils:	Recovery should be 65% - 135% for values $\geq$ 20X Detection Limit for soils digested by similar method to that used to obtain certified values
	For values < 20X Detection Limit, recovery should be $\pm$ 4X Detection Limit from the certified value
Blanks:	Blank concentrations should be less than 10% of lowest sample concentration

Acceptance Criteria for Inorganics in Water

Duplicates:	For values $\geq$ 20X Detection Limit, RPD $\leq$ 20%
	For values < 20X Detection Limit, difference must be within $\pm$ 1X Detection Limit
Spikes:	Recovery should be 80% - 120%
	Limit does not apply when sample value exceeds spike concentration by 5X or more
Reference materials:	Recovery should be 80% - 120% of the certified value for values $\geq$ 20X Detection Limit
	For values < 20X Detection Limit, recovery should be $\pm$ 4X Detection Limit from the certified value
Blanks:	Blank concentrations should be less than 10% of lowest sample concentration

ASSESSMENT of CARSON LAKE PASTURE DATA

The primary objective of the Carson Lake Pasture investigation was to determine whether the mercury level in soil of this area exceeded the Environmental Protection Agency's (EPA's) hazardous waste level criterion. A secondary objective was to assess whether mercury or any of the other 13 chemical constituents monitored posed a threat to either the environment in general or to public health or employee safety in particular.

In order to meet the objectives, soil samples were collected from the surface profile and at depths of two and five feet at 30 monitoring sites uniformly

distributed throughout the entire area. The samples were analyzed for total concentrations of a suite of trace elements and heavy metals. In addition, the samples were also measured for the leachable fraction of mercury. EPA's hazardous waste criterion for total mercury in soil is 20 mg/kg wet weight and the action level for mercury toxicity characteristic leaching potential (TCLP) is 0.20 mg/l. All samples were well below action levels for both total and TCLP mercury and therefore should not be classified as hazardous material based on the mercury evaluation alone.

The secondary objective can only be partially fulfilled without additional information. Because there are so many physical and chemical variables that can enhance or reduce the biological pathway and toxicity of chemicals present in the environment, one can only make gross assessments of potential environmental or public health impacts without designing specific studies to accurately measure them. Therefore only a general evaluation of the soil metal levels was made by comparing the total concentrations of the different elements in Carson Lake Pasture soils to baseline levels in soils of the Western United States. The baseline levels were established by the U.S. Geological Survey and are described in a publication produced by Tidball and Ebens in 1976.

A comparison of the Carson Lake Pasture results to baseline levels shows aluminum, barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc to be well within the normal range for western soils. However the mean concentrations of arsenic and lithium are approximately double the western background levels while mercury and selenium are more than ten-fold higher.

There are three major routes of potential exposure to the public and employees and they include airborne dusts, ingestion of contaminated livestock grazing in the pasture, and ingestion of waterfowl that may have bioaccumulated the elements as a result of their diet. However, additional studies would have to be performed to determine specific rates of exposure and if any health risks existed from such. The type of studies that could provide the data necessary to assess human health risks would be ambient PM-10 and total suspended particle air monitoring for the chemical elements in question, personal air sampling in which employees wear small air sampling devices during the course of their work, and liver and muscle analyses on both livestock and waterfowl to determine exposure levels in individual diets.

Potential impact to biota, especially waterfowl, could be determined from studies that measure the diets of the organisms and birds that reside or seasonally utilize the Carson Lake Pasture area. The environmental compartments that would have to be measured would include phytoplankton, zooplankton, insects, and various components of the native vegetation.

If you have any questions or comments on the above assessment, please contact either Pete Vonich or John Fields at 916-978-5581.

2/20/93

CARSON LAKE PASTURE

TOTAL MERCURY CONCENTRATION, MG/KG (WET WEIGHT)
HAZARDOUS WASTE CRITERIA: 20 MG/KG

TOXICITY CHARACTERISTIC LEACHING POTENTIAL MERCURY (TCLP), MG/L
HAZARDOUS WASTE CRITERIA: 0.2 MG/L

SITE NUMBER	SAMPLE A (0-6" depth)	SAMPLE B (21-27" depth)	SAMPLE C (57-63" depth)	SAMPLE A TCLP
1	2.44	0.69	0.07	-
2	2.91	0.20	0.08	-
3	6.02	1.77	0.16	<0.0001
4	2.14	0.11	0.11	-
5	7.34	1.39	0.08	<0.0001
6	5.54	1.75	0.34	0.0003
7	4.61	0.57	0.21	<0.0001
8	3.67	0.24	0.14	<0.0001
9	1.97	0.06	0.03	-
10	1.23	0.06	0.09	-
11	4.21	0.93	0.66	<0.0001
12	3.85	0.89	0.19	<0.0001
13	3.08	0.13	0.05	-
14	3.56	0.03	<0.03	<0.0001
15	4.76	2.63	0.27	<0.0001
16	5.43	0.98	0.10	<0.0001
17	1.89	0.45	0.10	-
18	9.38	0.48	0.04	0.0001
19	9.69	0.61	0.06	0.0002
20	12.9	0.35	0.10	0.0003
21	6.38	1.09	0.14	0.0001

SITE NUMBER	SAMPLE A (0-6" depth)	SAMPLE B (21-27" depth)	SAMPLE C (57-63" depth)	SAMPLE A TCLP
22	6.27	0.64	0.14	<0.0001
23	6.17	0.19	0.08	<0.0001
24	8.13	3.50	0.23	<0.0001*
25	10.9	1.17	0.13	0.0002
26	1.69	0.09	0.06	-
27	2.11	0.16	0.18	-
28	0.44	0.05	0.04	-
29	2.28	0.09	0.09	-
30	2.21	0.32	0.09	-
*24B				<0.0001
*24C				<0.0001

TCLP mercury was requested only for samples with total mercury values of greater than 3.50 mg/kg; method detection limits would not see TCLP mercury in samples with less than 4.0 mg/kg total mercury.

2/20/93

CARSON LAKE PASTURE
QUALITY ASSURANCE REVIEW

Total Mercury:

Analytical results of external quality assurance samples incorporated in batches submitted to CH2M Hill Laboratory in Redding, California, showed good accuracy and precision. A total of eight reference samples and four field duplicates were submitted to the laboratory, as well as three field variability duplicates. Relative percent difference (RPD) was also calculated for three pairs of duplicate reference samples. Two soil blanks were incorporated with given values of <0.10 mg/kg, and reported results were <0.03 and 0.09 mg/kg.

All of the reference samples had recoveries well within the 80-120 percent recovery criteria. The RPD between pairs of reference samples were all within the 65-135% RPD criteria for duplicate soil samples. Four of five field duplicate pairs had RPDs well within the above range, but one pair showed results with an RPD of 32.6%. However, a field variability sample taken five feet away from the duplicate pair had a result with an RPD of only 0.5% from the original sample. The pair of duplicates with an RPD of 32.6% were rerun with a resulting RPD of 20.3%, and with an average RPD from the original result of only 6.2%. The other two field variability pairs had results with RPDs of less than 10%.

One additional set of rerun requests was based on an anomaly of results for the B and C level samples. This one site (24) had a higher result for a C sample than the B sample, and that result was at a level significantly higher than all other C level samples. Reanalysis of both confirmed the value for the B level sample, and indicated that the original C level result had been in error. The data tables dated 2/20/93 reflect this change in the C level result.

The samples were all analyzed following EPA's Contract Laboratory Program (CLP) methods. The laboratory quality control and sample results from the

sample data packages have been reviewed and the rigorous CLP requirements and quality control criteria were all met with a few exceptions. The RPD between sample CKLP-30B and its laboratory duplicate (32.5%) exceeded CLP acceptance criteria, but was within Reclamation acceptance criteria for soil (35% RPD). The level of mercury in these samples (0.4096 and 0.5685 mg/kg) is close to detection level and only varies by 0.1589 mg/kg. This value is significantly lower than the hazardous waste action limit of 20 mg/kg and should not indicate any problems that would affect the usability of this data. Two pre-digestion spikes were diluted out of recoverable range; however, post-digestion spikes at a higher level resulted in acceptable recoveries.

TCLP Mercury:

External quality assurance samples incorporated in batches submitted for toxicity characteristic leaching potential (TCLP) mercury were limited to four sets of field duplicates and three field variability duplicates. The field duplicates showed no variance at all. The field variability duplicates, samples taken five feet from one another, showed minor differences which are insignificant due to the extremely low levels of soluble mercury found relative to hazardous waste criteria. This variability is likely to be due to actual site or subsample variability, and not to any analytical or sampling error judging from the outcome of all field duplicate results.

The TCLP mercury samples were also analyzed following EPA CLP methods and included the same rigorous quality controls. The sample data packages for the TCLP analyses have been reviewed, and all requirements and quality control criteria were met.

Evaluation of quality assurance and quality control sample results from CH2M Hill indicates that overall sample results are very good for both total mercury and TCLP mercury in soils from Carson Lake Pasture. No problems have been detected which could affect the usability of this data. For questions regarding this evaluation, please contact Kerry Rae at (916) 978-5581.

5/19/93

Carson Lake Pasture -- ICAP Metals

CLKP-XX'A' denotes 0"-6" sample
CLKP-XX'B' denotes 21"-27" sample
CLKP-XX'C' denotes 57"-63" sample

Element Site ID	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg
CLKP-1A	0.35	32,900	19.5	197	1.00	1.65	16.6	47.6
CLKP-1B	<0.20	31,550	18.0	175	0.90	1.60	16.0	42.9
CLKP-1C	<0.20	25,900	12.5	149	0.70	1.40	14.8	33.9
CLKP-2A	0.35	32,050	10.5	191	0.80	1.60	15.9	42.1
CLKP-2B	<0.20	31,150	9.50	178	0.80	1.50	15.5	36.8
CLKP-2C	<0.20	26,750	11.5	311	0.70	1.35	14.4	32.8

CLKP-3A	0.70	22,950	13.0	159	0.65	1.25	12.9	38.1
CLKP-3B	0.25	24,200	10.5	168	0.65	1.15	13.3	32.7
CLKP-3C	<0.20	22,600	10.0	171	0.55	1.20	12.0	30.2
CLKP-4A	0.45	27,950	10.0	166	0.60	1.50	14.3	35.7
CLKP-4B	<0.20	26,350	22.0	211	0.70	1.35	13.6	33.1
CLKP-4C	<0.20	24,200	21.0	172	0.60	1.15	12.9	33.0
CLKP-5A	0.70	32,050	19.5	175	0.85	1.55	16.2	53.5
CLKP-5B	<0.20	30,900	16.0	162	0.85	1.55	15.5	37.4
CLKP-5C	<0.20	30,750	19.0	115	0.85	1.55	15.6	39.6
CLKP-6A	0.55	30,150	9.00	173	0.75	1.55	15.3	42.3
CLKP-6B	<0.20	28,100	7.00	156	0.80	1.45	14.7	36.1
CLKP-6C	<0.20	29,250	13.0	159	0.80	1.55	15.1	35.4
CLKP-7A	0.40	26,900	9.50	168	0.70	1.40	13.4	37.4
CLKP-7B	<0.20	25,350	6.50	134	0.70	1.40	13.4	33.4
CLKP-7C	<0.20	22,000	9.50	111	0.65	1.35	12.2	29.7
CLKP-8A	0.60	27,800	10.0	167	0.70	1.45	14.9	40.1
CLKP-8B	<0.20	24,950	16.5	142	0.70	1.30	14.5	33.8
CLKP-8C	<0.20	25,350	16.0	175	0.65	1.20	13.2	35.6
CLKP-9A	0.35	28,400	15.0	170	0.75	1.55	14.3	40.0
CLKP-9B	<0.20	29,550	16.0	178	0.85	1.65	14.9	38.6
CLKP-9C	<0.20	29,450	17.5	117	0.85	1.40	15.2	37.3
CLKP-10A	<0.20	33,200	6.00	182	0.90	1.70	16.8	41.5
CLKP-10B	<0.20	26,550	7.00	97.0	0.85	1.50	14.7	37.2
CLKP-10C	<0.20	18,400	10.0	116	0.55	1.15	12.2	28.1
CLKP-11A	0.55	24,200	9.50	162	0.70	1.45	13.1	37.6
CLKP-11B	<0.20	24,500	12.0	142	0.70	1.35	13.1	33.9
CLKP-11C	<0.20	25,500	13.0	178	0.75	1.45	13.4	34.4
CLKP-12A	0.45	22,950	6.50	208	0.65	1.50	12.1	37.0
CLKP-12B	<0.20	22,100	8.00	132	0.65	1.30	11.5	31.0
CLKP-12C	<0.20	19,600	18.5	136	0.60	1.10	10.4	27.0
CLKP-13A	<0.20	28,200	8.50	173	0.85	1.65	14.3	38.9
CLKP-13B	<0.20	26,650	11.5	144	0.80	1.50	13.6	35.0
CLKP-13C	<0.20	28,800	18.5	185	0.85	1.60	14.2	38.3

Element Site ID	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg
CLKP-14A	0.40	33,950	12.5	221	0.95	2.00	17.6	52.0
CLKP-14B	<0.20	31,300	13.5	202	0.85	1.50	16.2	37.5
CLKP-14C	<0.20	32,600	7.00	145	0.85	1.60	15.9	37.7
CLKP-15A	0.35	24,100	7.00	169	0.70	1.50	13.6	38.9

CLKP-15B	<0.20	23,300	7.50	219	0.75	1.55	13.6	33.4
CLKP-15C	<0.20	18,250	7.50	129	0.55	1.15	11.5	26.0
CLKP-16A	0.25	26,600	6.00	165	0.70	1.65	14.3	36.8
CLKP-16B	<0.20	24,550	5.50	160	0.65	1.45	13.2	32.1
CLKP-16C	<0.20	22,150	18.5	208	0.65	1.15	11.4	32.8
CLKP-17A	0.30	27,500	7.00	180	0.85	1.75	15.2	41.2
CLKP-17B	<0.20	13,400	3.50	93.0	0.40	0.80	9.20	16.3
CLKP-17C	<0.20	14,400	4.50	69.0	0.60	1.00	10.1	20.6
CLKP-18A	1.05	34,150	9.00	180	0.80	1.80	17.8	48.6
CLKP-18B	<0.20	27,800	9.50	148	0.75	1.45	15.1	33.1
CLKP-18C	<0.20	3,790	9.00	64.0	0.15	0.35	3.45	5.45
CLKP-19A	0.80	30,750	17.0	195	0.75	1.75	16.4	47.1
CLKP-19B	<0.20	29,600	8.00	148	0.80	1.50	15.5	36.2
CLKP-19C	0.25	20,500	7.50	155	0.50	1.25	12.5	26.5
CLKP-20A	<0.20	25,350	5.50	155	0.70	1.60	14.0	31.7
CLKP-20B	1.05	23,900	12.0	163	0.65	1.55	13.2	43.0
CLKP-20C	<0.20	17,300	9.00	159	0.50	1.00	11.5	23.0
CLKP-21A	0.65	21,550	12.0	122	0.55	1.35	12.9	40.3
CLKP-21B	<0.20	25,000	8.50	142	0.75	1.60	14.2	33.7
CLKP-21C	0.30	19,450	13.5	154	0.50	1.15	10.5	19.8
CLKP-22A	0.60	27,550	11.0	169	0.75	1.45	15.0	38.1
CLKP-22B	<0.20	29,100	<2.50	149	0.75	1.45	15.0	34.9
CLKP-22C	<0.20	25,750	7.50	98.5	0.75	1.40	14.4	32.5
CLKP-23A	0.60	30,950	8.50	199	0.85	1.65	16.5	45.6
CLKP-23B	<0.20	29,050	4.00	158	0.70	1.50	15.3	32.7
CLKP-23C	<0.20	30,100	8.00	159	0.80	1.50	16.3	34.7
CLKP-24A	0.55	27,600	9.50	180	0.85	1.65	14.6	40.9
CLKP-24B	0.30	23,150	9.00	165	0.75	1.45	13.1	37.5
CLKP-24C	<0.20	16,250	8.00	56.5	0.55	1.05	9.95	26.2
CLKP-25A	0.80	25,450	9.50	191	0.80	1.45	14.8	47.1
CLKP-25B	<0.20	14,350	5.00	76.0	0.45	0.90	9.65	19.0
CLKP-25C	<0.20	18,500	8.00	118	0.55	1.05	12.8	25.4
CLKP-26A	0.20	27,100	11.5	178	0.75	1.60	13.9	39.4
CLKP-26B	<0.20	17,500	8.50	134	0.50	1.00	9.85	22.6
CLKP-26C	<0.20	21,200	8.50	98.5	0.65	1.30	11.7	29.8
CLKP-27A	0.40	14,250	7.50	101	0.40	1.05	9.65	23.2
CLKP-27B	<0.20	12,000	4.50	105	0.35	0.85	8.65	18.0
CLKP-27C	0.30	17,700	5.00	201	0.55	1.35	11.4	24.6
CLKP-28A	<0.20	8,900	9.00	61.5	0.25	0.60	6.60	10.9

CLKP-28B	<0.20	11,150	6.00	73.5	0.30	0.75	8.10	13.2
CLKP-28C	<0.20	9,650	2.50	65.5	0.25	0.65	7.45	10.5

Element Site ID	Ag mg/kg	Al mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg
CLKP-29A	<0.20	6,750	5.00	45.6	0.15	0.55	5.15	8.90
CLKP-29B	<0.20	10,600	6.50	121	0.30	0.65	8.45	12.6
CLKP-29C	<0.20	17,100	8.50	133	0.65	1.15	11.1	26.6
CLKP-30A	0.25	23,600	9.50	199	0.70	1.40	12.8	36.8
CLKP-30B	<0.20	24,950	24.5	206	0.70	1.50	13.0	37.5
CLKP-30C	<0.20	23,300	6.00	191	0.55	1.40	11.9	28.9

Samples were digested by EPA Method 3050 at Bureau of Reclamation's Missouri-Souris Office Soil and Water Laboratory in Bismarck, North Dakota. Samples were analyzed by ICP at Reclamation's Mid-Pacific Water Quality Laboratory in Sacramento, California.

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Carson Lake Pasture -- ICAP Metals

CLKP-XX'A' denotes 0"-6" sample
CLKP-XX'B' denotes 21"-27" sample
CLKP-XX'C' denotes 57"-63" sample

Element Site ID	Li mg/kg	Ni mg/kg	Pb mg/kg	Se mg/kg	Zn mg/kg
CLKP-1A	75.5	18.0	21.0	3.00	112
CLKP-1B	65.5	16.5	15.0	4.00	102
CLKP-1C	47.2	14.0	11.5	3.50	80.0
CLKP-2A	67.5	15.5	13.5	<2.50	93.0
CLKP-2B	58.0	16.0	11.0	<2.50	87.0
CLKP-2C	57.5	14.0	9.50	<2.50	75.5
CLKP-3A	59.5	13.0	17.0	3.00	78.5
CLKP-3B	57.0	13.5	12.5	2.50	78.5
CLKP-3C	54.0	12.0	8.50	<2.50	71.5
CLKP-4A	67.0	15.5	13.5	<2.50	81.0
CLKP-4B	54.4	13.0	11.0	4.00	84.0
CLKP-4C	53.0	13.5	11.0	4.50	82.0
CLKP-5A	64.5	15.5	19.0	3.00	102
CLKP-5B	57.0	16.0	13.0	<2.50	93.5
CLKP-5C	58.0	16.0	14.0	5.00	94.0
CLKP-6A	64.5	15.0	14.5	<2.50	89.5
CLKP-6B	55.5	14.0	11.5	5.00	85.5
CLKP-6C	54.5	13.5	10.5	2.50	85.5
CLKP-7A	66.0	14.5	15.0	<2.50	83.0
CLKP-7B	56.0	14.0	12.5	4.00	81.0
CLKP-7C	42.3	12.5	11.5	4.50	69.0
CLKP-8A	70.0	14.0	15.0	<2.50	87.5

CLKP-8B	57.5	15.0	13.0	<2.50	83.0
CLKP-8C	56.0	13.5	10.5	4.50	80.5
CLKP-9A	62.0	14.5	15.0	<2.50	93.5
CLKP-9B	56.0	15.5	14.5	<2.50	92.5
CLKP-9C	55.0	14.5	12.5	3.00	94.0
CLKP-10A	61.0	16.5	15.0	3.50	96.5
CLKP-10B	52.5	15.0	13.5	3.00	89.5
CLKP-10C	29.0	11.0	10.0	<2.50	66.0
CLKP-11A	60.0	15.0	17.5	4.00	83.5
CLKP-11B	52.5	14.0	12.5	<2.50	80.0
CLKP-11C	52.5	15.0	12.5	3.00	81.5
CLKP-12A	61.5	12.5	15.0	<2.50	79.0
CLKP-12B	53.0	11.5	10.5	<2.50	79.0
CLKP-12C	47.9	11.5	10.5	<2.50	71.5
CLKP-13A	57.5	16.0	14.5	3.50	93.0
CLKP-13B	52.5	15.0	13.0	3.00	85.5
CLKP-13C	54.5	15.5	14.0	<2.50	92.5

Element Site ID	Li mg/kg	Ni mg/kg	Pb mg/kg	Se mg/kg	Zn mg/kg
CLKP-14A	74.0	17.5	18.5	7.50	110
CLKP-14B	55.5	15.5	15.0	<2.50	91.0
CLKP-14C	56.0	15.5	13.0	3.00	90.5
CLKP-15A	57.5	15.0	16.5	<2.50	88.0
CLKP-15B	51.0	14.5	12.5	<2.50	86.0
CLKP-15C	33.6	12.0	11.0	<2.50	65.5
CLKP-16A	60.0	14.5	14.5	<2.50	87.5
CLKP-16B	51.0	13.5	12.0	5.00	79.0
CLKP-16C	52.0	13.0	10.0	<2.50	74.0
CLKP-17A	56.0	16.0	16.0	2.50	100
CLKP-17B	20.5	8.00	8.00	<2.50	47.0
CLKP-17C	22.2	10.0	9.00	<2.50	56.0
CLKP-18A	65.5	18.0	24.0	4.00	106
CLKP-18B	45.0	15.5	13.5	3.50	80.5
CLKP-18C	5.00	3.50	4.00	<2.50	15.4
CLKP-19A	64.5	16.0	28.0	3.50	99.0
CLKP-19B	55.0	14.0	12.5	3.00	87.5
CLKP-19C	29.9	11.5	8.00	<2.50	58.0
CLKP-20A	48.7	13.5	13.0	<2.50	82.5

CLKP-20B	56.0	13.0	22.5	<2.50	86.5
CLKP-20C	31.2	9.50	9.50	<2.50	58.5
CLKP-21A	39.6	12.5	18.5	5.00	78.5
CLKP-21B	48.7	15.0	15.0	<2.50	82.5
CLKP-21C	30.6	10.0	9.00	<2.50	56.5
CLKP-22A	51.0	14.0	21.5	3.00	87.0
CLKP-22B	53.5	14.0	12.5	<2.50	83.5
CLKP-22C	44.5	13.5	9.50	3.00	76.5
CLKP-23A	60.5	17.0	19.5	4.00	102
CLKP-23B	49.6	14.0	12.0	<2.50	79.0
CLKP-23C	46.2	14.0	14.0	5.00	79.0
CLKP-24A	58.0	15.5	26.5	4.00	95.0
CLKP-24B	49.2	14.5	16.5	<2.50	85.5
CLKP-24C	29.8	9.50	9.50	<2.50	56.5
CLKP-25A	54.5	15.0	21.0	<2.50	95.0
CLKP-25B	23.6	9.00	7.00	<2.50	46.2
CLKP-25C	29.1	10.5	9.00	<2.50	60.0
CLKP-26A	52.5	14.5	14.5	<2.50	98.5
CLKP-26B	30.2	10.5	9.50	<2.50	57.5
CLKP-26C	37.1	12.0	11.0	<2.50	70.0
CLKP-27A	23.5	10.0	12.0	<2.50	57.5
CLKP-27B	18.0	8.50	7.00	<2.50	43.4
CLKP-27C	26.3	12.0	10.5	<2.50	66.0
CLKP-28A	13.9	5.50	7.00	<2.50	31.8
CLKP-28B	19.8	8.50	6.50	<2.50	38.0
CLKP-28C	14.3	6.50	6.50	<2.50	35.5

Element Site ID	Li mg/kg	Ni mg/kg	Pb mg/kg	Se mg/kg	Zn mg/kg
CLKP-29A	11.5	4.50	6.50	<2.50	24.8
CLKP-29B	13.7	7.50	6.50	<2.50	39.1
CLKP-29C	27.9	12.0	10.5	2.50	61.5
CLKP-30A	62.0	14.0	14.0	<2.50	87.5
CLKP-30B	61.5	13.5	12.0	3.50	89.5
CLKP-30C	56.0	12.5	11.0	3.50	67.0

Samples were digested by EPA Method 3050 at Bureau of Reclamation's Missouri-Souris Office Soil and Water Laboratory in Bismarck, North Dakota. Samples were analyzed by ICP at Reclamation's Mid-Pacific Water Quality Laboratory in Sacramento, California.

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Carson Lake Pasture--ICAP Metals
Quality Assurance Review Summary

The ninety soil samples from Carson Lake Pasture Mercury Superfund Site were collected in December, 1992. Analyses for mercury were conducted immediately,

and are addressed in a separate review. This summary reviews the results of the EPA Method 3050 digestion performed by Reclamation's Soil and Water Laboratory in Bismarck, North Dakota, and the following ICP analyses performed by Mid-Pacific Region's Water Quality Laboratory in Sacramento, California. Submitted with the samples were a number of external quality assurance samples including five reference soils, four field duplicates, and three collocated samples taken approximately five feet away to test site variability. Additional extraction quality assurance samples were digested with the batch at the Bismarck Laboratory, and included ten duplicates, six spiked duplicates, and six blanks.

Overall, results of the quality assurance samples were very good. Specific problems were noted at the element level, and are addressed in this summary. Where initial results exceeded quality control acceptance criteria, the existing extracts were reanalyzed and any significant changes were recorded. The amount and direction of these changes were noted, and any notable tendencies are discussed below. Elements that are not specifically addressed here did not have any notable problems.

The first element to have qualified results is silver. Blanks were all below detection. Field duplicate relative percent differences (RPD's) were all within acceptance limits, and two of the three collocated samples were also within limits. The one collocated sample that displayed variability in silver also displayed variability beyond limits in arsenic and copper, indicating that the area around site CLKP-20 may have definite variations in composition.

The RPD between extraction duplicates was acceptable for all but one pair. This pair was a homogenous reference soil, and the regular sample had an acceptable recovery. The duplicate, however, had a much lower recovery, which was confirmed upon reanalysis. The difference may have been an actual difference in the small portion of soil taken for digestion, or silver may have been lost during the process by precipitation. One other pair of extraction duplicates from a reference sample had very good precision, but both duplicates had very low recoveries. Of six extraction spikes, two silver spikes had low recoveries, again confirmed by reanalysis.

The low recoveries for silver ranged from 33% to 58%, while recoveries in several spiked and reference samples ranged from 91% to 96%. Concentrations of silver in the Carson Lake soils were at or below 1.05 mg/kg, and while these could potentially have been as high as 3 mg/kg based on the lowest recovery, 65% of the samples had concentrations below the detection limit of 0.20 mg.kg. A few of these samples could have been as high as 0.6 mg/kg given the low bias of 40% of the recovery checks.

Arsenic was another element with some variable quality assurance results. Arsenic was below detection in all blanks, and had recoveries from 93% to 98% in reference soils. Recoveries in all but one extraction spike were also acceptable, which was 140%. The variability with arsenic was in precision, with several pairs of duplicates having RPD's greater than acceptance limits after the initial analyses. After reanalysis many of the values were within

acceptance criteria, but some had changed by as much as 4 mg/kg in either direction. However, several reanalyses did not change significantly. Arsenic does not appear to have a bias either low or high, just a range of precision possibly as high as 4 mg/kg.

Chromium had very tight precision results, and showed good recoveries from reference samples. One extraction blank did show chromium at a level of 0.022 mg/l, or 1.1 mg/kg, and two others had a level of 0.019 mg/l. This could be significant to a site with lower chromium values such as CLKP-28 with concentrations ranging from 6.60 mg/kg to 8.10 mg/kg, but most sites have concentrations at least ten times greater than the blanks and should not have been affected.

Copper also had very good precision and good recoveries, but was present in an extraction blank at a level of 0.032 mg/l, or 1.60 mg/kg. However, all but two samples had concentrations of ten times this or far greater and should not have been affected.

Lithium is not an element targeted specifically in EPA Method 3050 digestion, and no certified values are given for lithium in the reference soils used here. However, lithium was added to half of the extraction spikes and showed very good recoveries, and RPD's between field and extraction duplicates were excellent. Laboratory quality control samples also showed good precision and accuracy, so it appears reasonable to assume that lithium data reported here is completely valid.

Zinc appears in one extraction blank, but at a level of 0.026 mg/l, or 1.3 mg/kg, it is insignificant to the concentrations seen in the soil samples here.

In summary, this review notes that silver recoveries are inconsistent and sometimes low; that arsenic has an uncertainty level possibly as high as 4 mg/kg, and that field collocated samples taken at a five foot distance from regular samples do indicate some significant variability for levels of arsenic, copper, silver, and lead in the soil at Carson Lake Pasture. All other quality assurance checks showed very good results, and with the exceptions that have been noted here, data in this report for metals analyzed by ICP is valid and supportable.

Carson Lake Pasture
Field Duplicates

Field ID	CLKP-23A / CLKP-35A		CLKP-19A / CLKP-34A		CLKP-5A / CLKP-38A	
Labid	16053 / 16049		16073 / 16069		16090 / 16099	
Element		RPD		RPD		RPD
Ag	0.60	0.60 0 %	0.80	0.85 6.1 %	0.70	0.70 0 %
Al	30,950	33,250 7.2 %	30,750	30,300 1.5 %	32,050	28,950 10 %
As	13.0	7.00 60 %	17.0	18.0 5.7 %	19.5	15.0 26 %
Ba	199	207 3.9 %	195	199 2.0 %	175	169 3.5 %
Be	0.85	0.90 5.7 %	0.75	0.75 0 %	0.85	0.70 19.4 %
Cd	1.65	1.80 8.7 %	1.75	1.65 5.9 %	1.55	1.45 6.7 %
Cr	16.5	17.4 5.3 %	16.4	15.7 4.4 %	16.2	15.3 5.7 %
Cu	45.6	46.8 2.6 %	47.1	46.4 1.5 %	53.5	42.9 22 %
Li	60.5	64.0 5.6 %	64.5	62.5 3.1 %	64.5	60.0 7.2 %
Ni	17.Q	17.5 2.9 %	16.0	15.0 6.5 %	15.5	15.5 0 %

Pb	19.5	20.0		28.0	24.0		19.0	19.0
		2.5 %			15 %			0 %
Se	4.00	3.00		3.50	4.00		3.00	<2.50
		<2XDL			<2XDL			<2XDL
Zn	102	103		99.0	98.5		102	92.0
		1.0 %			0.5 %			10 %

Carson Lake Pasture
Field Duplicates

Field ID	CLKP-24A / CLKP-45A
Labid	16249 / 16255

Element		RPD
Ag	0.55	0.40
		<2XDL
Al	27,600	28,450
		3.0 %
As	9.50	9.50
		0 %
Ba	180	179
		0.6 %
Be	0.85	0.85
		0 %
Cd	1.65	1.65
		0 %

Cr	14.6	15.2
	4.0 %	
Cu	40.9	40.7
	0.5 %	
Li	58.0	57.0
	1.7 %	
Ni	15.5	16.5
	6.3 %	
Pb	26.5	19.0
	33 %	
Se	4.00	4.50
	<2XDL	
Zn	95.0	96.0
	1.0 %	

Carson Lake Pasture
Field Collocated Samples (Approx. 5 foot distance)

Field ID	CLKP-5A / CLKP-42A		CLKP-20A / CLKP-43A		CLKP-24A / CLKP-44A	
Labid	16090 / 16049		16240 / 16239		16249 / 16259	
Element		RPD		RPD		RPD
Ag	0.70	0.60	<0.20	0.65	0.55	0.50
	<2XDL		> 2XDL		<2XDL	
Al	32,Q50	33,250	25,350	22,800	27,600	26,750
	3.7 %		11 %		3.1 %	

As	19.5	7.00		13.0	5.50		9.50	7.50
		94 %			70 %			24 %
Ba	175	207		155	148		180	175
		17 %			4.6 %			2.8 %
Be	0.85	0.90		0.70	0.55		0.85	0.75
		5.7 %			24 %			13 %
Cd	1.55	1.80		1.40	1.60		1.65	1.65
		15 %			13 %			0 %
Cr	16.2	17.4		14.0	12.2		14.6	14.2
		7.1 %			14 %			2.8 %
Cu	53.5	46.8		31.7	80.0		40.9	41.8
		13 %			86 %			2.2 %
Li	64.5	64.0		48.7	53.0		58.0	54.0
		0.8 %			8.5 %			7.1 %
Ni	15.5	17.5		13.5	12.5		15.5	15.0
		12 %			7.7 %			3.3 %
Pb	19.0	20.0		13.0	18.0		26.5	18.5
		5.1 %			32 %			36 %
Se	3.00	3.00		<2.50	2.50		4.00	3.50
		<2XDL			<2XDL			<2XDL
Zn	102	103		82.5	95.0		95.0	90.5
		1.0 %			14 %			4.9 %

Carson Lake Pasture
Reference Sample Results

Reference:	ERA BMD-57	ERA PPS-46	*NIST Buf.R.
Field ID:	CLKP-36A	CLKP-33A	CLKP-32A

Labid: / Element:	16059 Act/Exp % Rec	16076 Act/Exp % Rec	16089 Act/Exp % Rec
Ag	<0.20 / <2.0 -	83.5 / 92.1 91 %	0.30 / -
Al	6,600 / 4,420 149 %	4,830 / 4010 120 %	12,650 / 12,220 104 %
As	<2.50 / <2.0 -	134 / 144 93 %	23.0 / 23.4 98 %
Ba	54.5 / <100 -	188 / 206 91 %	79.5 / 414 19 %
Be	0.35 / <1.0 -	77.0 / 85.7 90 %	0.50 / -
Cd	0.60 / <1.0 -	122 / 129 93 %	4.45 / 3.45 129 %
Cr	8.35 / <20 -	92.5 / 100 93 %	78.0 / 135 58 %
Cu	5.10 / <20 -	91.5 / 101 91 %	90.0 / 98.6 91 %
Li	5.65 / - 	4.50 / - 	29.9 / 47.5 63 %
Ni	4.50 / <10 -	129 / 136 95 %	35.0 / 44.1 79 %
Pb	10.0 / <30 -	121 / 118 103 %	154 / 161 96 %
Se	<2.50 / <1.0 -	157 / 165 95 %	4.00 / 4.50 89 %
Zn	29.9 / <50 -	153 / 160 96 %	418 / 438 95 %

*Certified values are by Total digestion, not 3050, so low recoveries are acceptable.

Carson Lake Pasture
Reference Sample Results

Reference:	ERA PPS-46	ERA BMD-57
Field ID:	CLKP-39A	CLKP-41A
Labid:	16219	16260
Element:	Act / Exp % Rec	Act / Exp % Rec
Ag	32.2 / 92.1 35 %	<0.20 / <2.0 -
Al	4,280 / 4010 107 %	4,605 / 4420 104 %
As	134 / 144 93 %	<2.50 / 2.0 -
Ba	182 / 206 88 %	46.7 / <100 -
Be	78.0 / 85.7 91 %	0.25 / <1.0 -
Cd	123 / 129 95 %	0.50 / <1.0 -
Cr	93.0 / 100 93 %	5.45 / <20 -
Cu	90.0 / 101 89 %	4.35 / <20 -
Li	3.85 / - -	4.55 / - -
Ni	130 / 136 96 %	4.00 / <10 -
Pb	123 / 118 104 %	8.00 / <30 -
Se	157 / 165 95 %	<2.50 / <1.0 -
Zn	157 / 160	24.5 / <50

	98 %	-

Carson Lake Pasture
Extraction Duplicates

Bismarck ID	931681	931363	931691	931364	931705	931365
Field ID	CLKP-18A		CLKP-21A		CLKP-6A	
Labid	16046	16102	16056	16103	16070	16104
Element		RPD		RPD		RPD
Ag	1.05	0.95	0.65	0.65	0.55	0.45
		10 %		<2XDL		<2XDL
Al	34,150	29,000	21,550	24,400	30,150	30,050
		16 %		11 %		0.3 %
As	9.00	10.9	12.0	13.0	9.00	12.0
		19 %		8.0 %		29 %
Ba	180	176	122	125	173	174
		2.2 %		2.4 %		0.6 %
Be	0.80	0.80	0.55	0.60	0.75	0.80
		0 %		8.7 %		6.5 %
Cd	1.80	1.65	1.35	1.30	1.55	1.60
		8.7 %		3.8 %		3.2 %
Cr	17.8	16.4	12.9	14.2	15.3	16.1
		8.2 %		9.6 %		5.1 %
Cu	48.6	46.2	40.3	39.2	42.3	41.5
		5.1 %		2.8 %		1.9 %
Li	65.5	62.0	39.6	43.7	64.5	64.0
		5.5 %		9.8 %		0.8 %
Ni	18.0	17.0	12.5	12.5	15.0	15.5
		5.7 %		0 %		3.3 %

Pb	24.0 22.0 8.7 %	18.5 17.0 8.5 %	14.5 17.0 15.9 %
Se	4.00 4.00 0 %	5.00 3.00 <2XDL	<2.50 5.00 <2XDL
Zn	106 104 1.9 %	78.5 81.5 3.8 %	89.5 94.5 5.4 %

Carson Lake Pasture
Extraction Duplicates

Bismarck ID	931711	931366	931715	931367	931735	931396
Field ID	CLKP-33A*		CLKP-8A		CLKP-39A*	
Labid	16076	16105	16080	16106	16219	16195
Element	RPD		RPD		RPD	
Ag	83.5 34.2 84 % (37)		0.60 0.50 <2XDL		32.2 30.3 6.1 % (33)	
Al	4,830 4,510 6.9 % (112)		27,800 27,700 0.4 %		4,280 4,570 6.6 % (114)	
As	134 140 4.4 % (103)		10.0 8.00 22 %		134 143 6.5 % (101)	
Ba	188 196 4.2 % (95)		167 165 1.2 %		182 198 8.4 % (96)	
Be	77.0 80.0 3.8 % (93)		0.70 0.70 0 %		78.0 84.5 8.0 % (99)	
Cd	122 125 2.4 % (97)		1.45 1.50 3.4 %		123 133 7.8 % (103)	

Cr	92.5	96.0		14.9	14.8		93.0	102
		3.7 %	(96)		0.7 %			9.2 % (102)
Cu	91.5	95.0		40.1	38.5		90.0	96.5
		3.8 %	(94)		4.1 %			7.0 % (96)
Li	4.50	4.30		70.0	69.0		3.85	4.20
		4.5 %	(-)		1.4 %			8.7 % (-)
Ni	129	132		14.0	14.5		130	141
		2.3 %	(97)		3.5 %			8.1 % (104)
Pb	121	125		15.0	15.0		123	134
		3.3 %	(106)		0 %			8.6 % (114)
Se	157	161		<2.50	2.50		157	167
		2.5 %	(98)		<2XDL			6.2 % (101)
Zn	153	156		87.5	86.5		157	167
		1.9 %	(98)		1.1 %			6.2 % (104)

*Sample is a homogenous, ERA reference sample, with recoveries added here for the duplicate.

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Carson Lake Pasture
Extraction Duplicates

Bismarck ID	931750	931397		931752	931398		931766	931441
Field ID	CLKP-27B			CLKP-26A			CLKP-24B	
Labid	16234	16196		16236	16197		16250	16202
Element		RPD			RPD			RPD
Ag	<0.20	<0.20		0.20	0.25		0.30	0.25
		<2XDL			<2XDL			<2XDL
Al	12,000	11,500		27,100	25,250		23,150	24,950
		4.3 %			7.1 %			7.5 %
As	4.50	9.50		11.5	11.0		9.00	9.00